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Research paper

Region of Interest (ROI) for EEG Activity in Depressed Young Adult

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Abstract

Several abnormal neural activities in regions such as dorsolateral prefrontal cortex (DLPFC) and prefrontal cortex (PFC) are known to be associated with depression. However most studies focused on major depression disorder and less on mild and moderate depression, moreover, these studies are mostly conducted in United State and European countries. This study uses data from 12 mild and moderately depressed and 12 healthy control young adult in Malaysia to examine the differences in brain activity via spectrum and coherence analysis in quantitative electroencephalography (qEEG). The study found that depressed group have higher beta on the anterior region that is found on people with depression and recurrent depression in previous studies, and higher theta on the prefrontal cortex may associate with deficits in attention and working memory in resting state compare to healthy control. Furthermore, left and right frontal showed low beta2 coherence that may indicate imbalance of functional processes.

Keywords: *prefrontal cortex; depression; qEEG; beta; theta.*

1. Introduction

Depression is the most common mental disorders occurred in Malaysia. The prevalence of depression in Malaysia is approximately between 3.9 to 46% [1]. This statistics is comparable of the prevalence that is occurring in developed countries and has become a concerning issue. Various brain imaging research has been done to understand the changes that occurs on brain activity of those suffering depression and these studies have found out several areas of the cerebral cortex reflected anomalies such as DLPFC, PFC and; bigger area such as the anterior and the posterior regions [2– 4].

A large amount of study on the brain activity of depression was done using Electroencephalography (EEG) because it is inexpensive, easy to use, high mobility and high temporal resolution. Therefore, EEG is commonly used to investigate brain activity. Previous findings using EEG has demonstrated the differences in brain activity of those suffering depression in comparison to a healthy person. Finding from Debener, and colleagues shows that in resting state, depressed group has higher alpha activity on the right than left anterior region of the brain [5]. While other studies have shown differences in other region like higher beta on the anterior region [6], higher delta on the posterior region [4], higher alpha on DLPFC and PFC, higher theta in anterior cingulate cortex (ACC) [7, 8], higher theta and alpha on parietal and occipital lobe [9] in depressed groups.

Most of the previous studies also focus heavily on major depression disorder, therefore leaving mild and moderately depressed group less explored. The present study examined the anomalies in brain activity of those suffering mild and moderate depression during resting state.

2. Methods

2.1 Subjects

Twenty six subjects were recruited from a local university in Malaysia to participate in this study. The criteria of participation are Malaysian with age range from 18 to 30 years old. The selection of participants for this study is based on their Beck Depression Inventory (BDI) scores. A BDI score of below 14 are considered non-depressed and will be group as healthy control and A BDI-II score between 14 to 28 are group as depressed. The depressed participants are recommended by university counsellors in the student affair counselling department before the process of grouping via BDI scores. 12 participants (2 male, 10 female) were grouped into depressed group and 12 participants (8 male, 4 female) were grouped into healthy control group. One participant was excluded from the study because her BDI scores indicated severe depression, while another subject from healthy control was removed due to technical faulty. All the participants were properly informed on the nature and procedure of this study and signed the informed consent form before participating.

2.2 Task and Experimental Procedure

The participants are properly briefed a day before the actual EEG sessions to abstain from caffeine, nicotine and alcohol at least 8 hours prior to the session. Besides that, they are informed to not apply any hair products before the sessions to ensure the precision of the data collection. The EEG session took place in a quiet, light-dimmed and air-conditioned room. The EEG was acquired with 25-channel Mitsar EEG-201 and the electrodes are positioned according to the International 10-20 system. (Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, O2) with ref-